BSc Mechanical Engineering

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Innovation Report

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Solar Charging Pendant

Summary

This report is based on research and development, and the ability to design and market a new product. Design ideas, drawings and ability are crucial and determine the materials, components and outcome of the innovation. This is explained throughout this report and fully justified, with conclusions using relevant methodologies.

Acknowledgements

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Contents

Introduction

This report is based on an innovation of charging small Indoor solar devices via LED Daylight Projectors.

The idea is that a light fitting base (Pattress) should be fitted with LED Day Light Projectors, these Projectors are pointed at Solar Powered Devices within homes and offices. There are two parts to this design- this report focuses on just the Solar Charging Pendant.

Devices and Detectors

Utilising the LED's efficient power and spectrum, devices such as Carbon Monoxide, heat and smoke Detectors could be innovated in design and incorporate a solar panel with a backup rechargeable battery. When lights in the room are on, the LED Projectors are charging the device, when the lights are off, the devices rely on either natural daylight or the battery backup.

Electrical Energy

This reduces the energy consumption used by detectors or devices, it also reduces the wiring and installation cost. Mains operated smoke alarms use 0.8 Watts per kilowatt p/hour, however true power suggests that it runs higher than this, in some case up to 17 Watts per detector. Another reason is that mains operated smoke alarms and carbon monoxide detectors waste energy when converting energy from AC to DC, which is not an efficient method- DC direct from a solar Panel without a conversion is a more efficient method.

Battery

My design also reduces the use of battery's, the addition of Solar adds a backup system to battery operated devices where mains applications are difficult, and costly, adding solar allows for a more effective and long-lasting battery.

How Does This Work

By using the LED Projectors incorporated into a Pendant, we use a small amount of power from the mains to power the LED Driver. Research suggests 0.5 watts is used to power the LED's Driver, the output of the LED lamp could be as high as 12 watts, which makes it an efficient method of charging solar devices indoors.

Why

These devices use either battery, or mains power, however using LED projectors reduces energy consumption through AC to DC conversion, and it does this wirelessly and safely.

Drawbacks

- Dark rooms with no lighting
- No natural light to help charge devices
- Ceiling mount only
- Distance of devices is limited

Plan of Work

Gantt Chart, showing Product Design Specification

Table 1 (Gantt Chart)

PDS	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12
Idea	SCP											
Ability		Research										
Customer Requirements			Client	Focus					client			
Functional & Product Specification					Design							
Review Design												
Test Market												
Introduction												
Critical Evaluation												

A Gantt chart enables us to set time-specific targets and show a future layout, the drawback is Gantt Charts tend to change from start of a design to finish.

Potential Problem Analysis (Kepner Tregoe)

Table 2 (Kepner Tregoe)

Potential Problem	Consequences	Possible Causes	Prevention	Contingency Plan
Electric shock	Death	Faulty wiring, earth Disconnected, Incompetence	Double Insulated Parts	Design factor, Competent Person
Cost	Won't be able to sell	Expense of material, and staff	Cost effective material	Source from suppliers, buy in bulk and save.

Marketing	Won't be able to sell	Cost, practicality	Competitive price, make it practical.	Target correct audience.

Kepner Tregoe chart identifies problems that could arise due to environment. This chart helps highlight Problem areas before we even begin the design process.

Stakeholder Analysis

Who has an interest in my design?

Table 3 (Stakeholder Chart)

Stakeholder	**Area of Interest**	**What is considered valuable**	**Hopes, Aspirations for Design**	**Fears and concerns**
Me	Homes and Offices	cost, quality, efficiency, sustainability, impact, equity.	That it is mass produced and sold as an efficient charging source.	Better technology becomes available.
Customers	Home, Factory, schools,	Cost and quality	Reduced cost in batteries and electricity.	Faulty products, reliability.

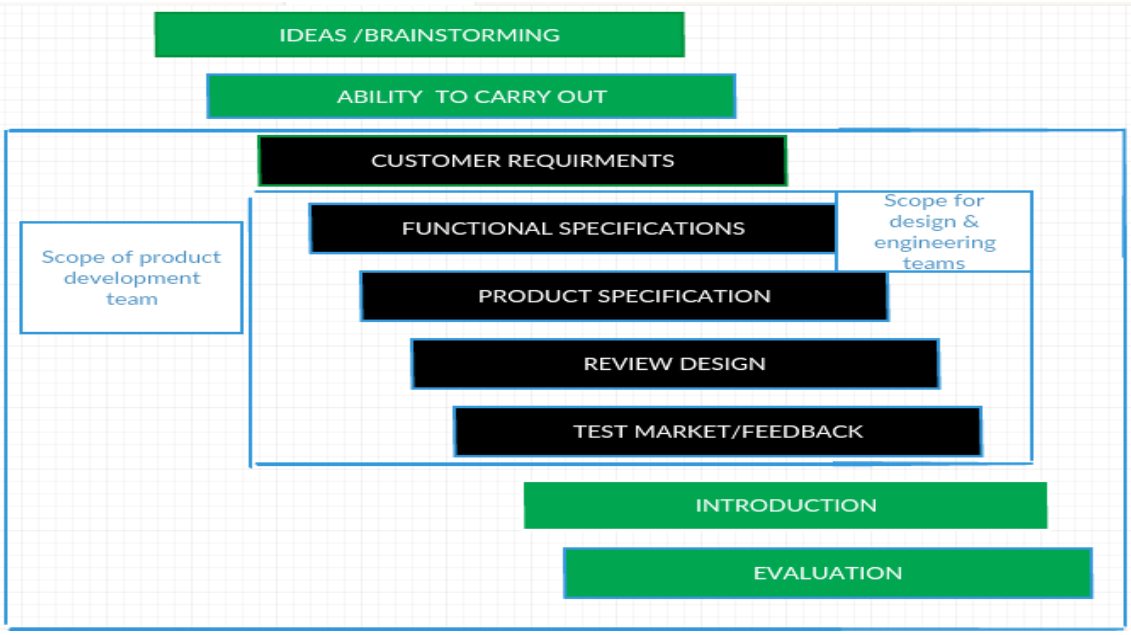
This chart shows people who have an interest in my idea, so far, but it may change to include more stakeholders.

Methodology

Two types of problems, ones we know, ones we don't, if you don't know what your innovating use a method called TRIZ, if you know what you are innovating, a Product Design Specification can be utilised to structure the project.

Product Design Specification (PDS)

Table 4 (Product Design Specification)



PDS shows stages of development in an orderly fashion.

Ideas

First, I took some ideas for development, an insight into what is required.

LED Light

Figure 1 (Picture of GU 10 LED Lamp)

(Wholesaleledlights.co.uk, 2017)

LED Layout

Figure 2 (Picture of LED Pattern)

(www.banggood.com, 2017)

Lighting Pendant

Figure 3 (Picture of Lighting Pendant)

(White Ceiling Rose Pendant Set, 2017)

LED Driver

Specification	
Wattage	0.5W
Equivalent To	12W
Voltage	220-240V 50/60Hz V
Power Consumption	0.5W
Dimensions	Length 90mm x Width 40mm x Height 20mm

Figure 4 (Picture of LED Driver)

(Energylightbulbs.co.uk, 2017)

Batten Holder

Figure 5 (Picture of Lighting Pendant)

(Qvsdirect.com, 2017)

After looking at relevant designs for input, I roughly sketched my ideas.

Drawing1

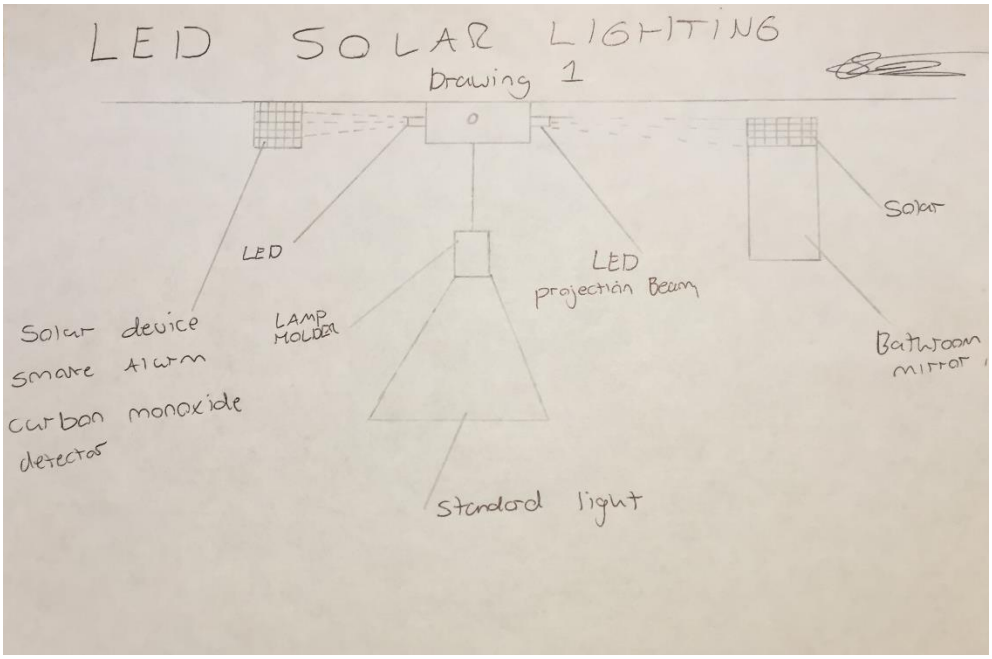


Figure 6 (Design Drawing 1)

Drawing 2

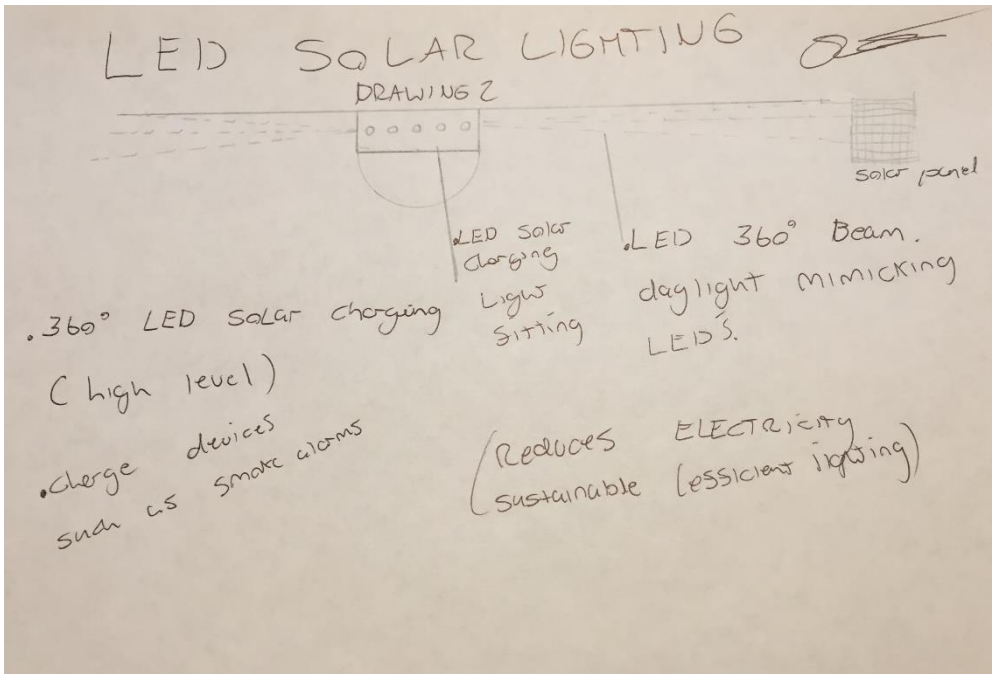


Figure 7 (Design Drawing 2)

Drawing 3

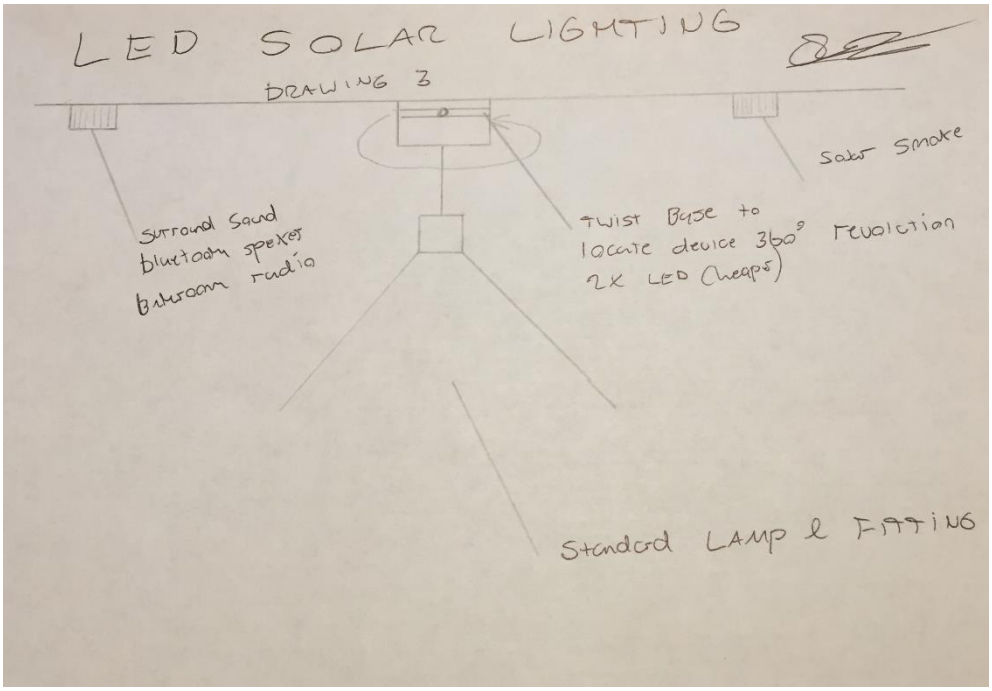


Figure 8 (Design Drawing 3)

Drawing 4

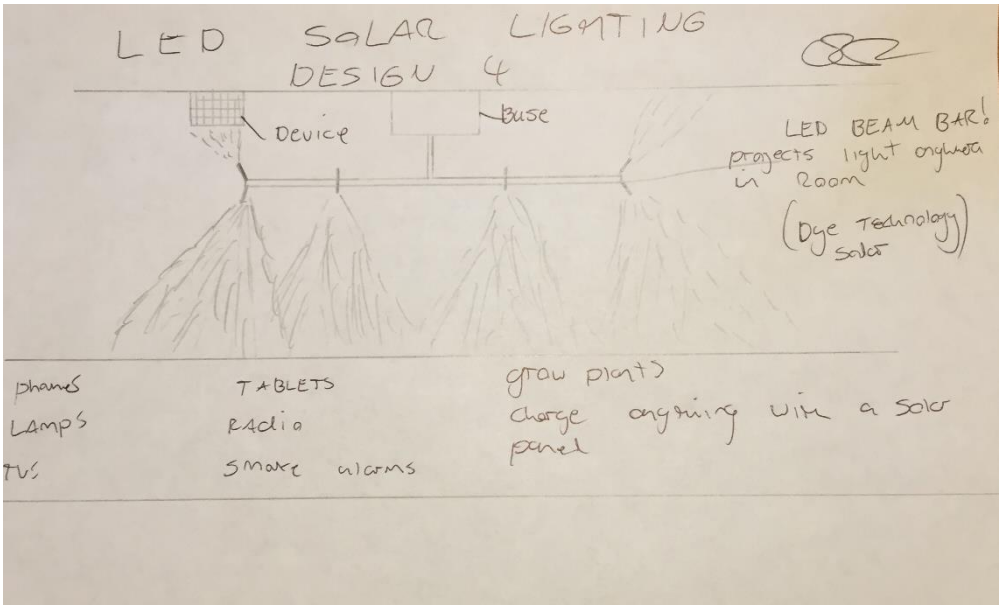


Figure 9 (Design Drawing 4)

Choose Drawing Using Pugh and Matrix

Table 5 (Pugh and Matrix Chart Comparing Design Drawings)

Criteria	Ideal	Design 1	Design 2	Design 3	Design4
Cost	S	S	+	S	+
Practicality	S	S	-	S	-
Ability	S				
Charging Capabilities	S	S	+	S	+
Regulations	S	S	S	S	-
Efficiency	S	S	-	+	-
Sustainability	S	S	-	S	-
Total +	0	0	2	0	2
Total -	0	0	3	0	4
Total Score	0	0	-1	1	-2

Decision

The Pugh and Matrix chart compares the ideal design against my designs. We can see that Design 3 meets the requirements best as it uses minimum LEDS, and by allowing the base to rotate 360 degrees, the LED projectors can line up with any device, whereas drawing 1 has situated LED Projectors which limit where devices can be placed, designs 2 and 3 uses too much power and sustainability is ineffective. Design 4 is in breach of regulations as LED's can blind people at close range, If the lights are angled towards the ground from ceiling, this will involve human contact, so the idea is not going to be used, even though it has the highest charging capability.

Decision Drawing 3

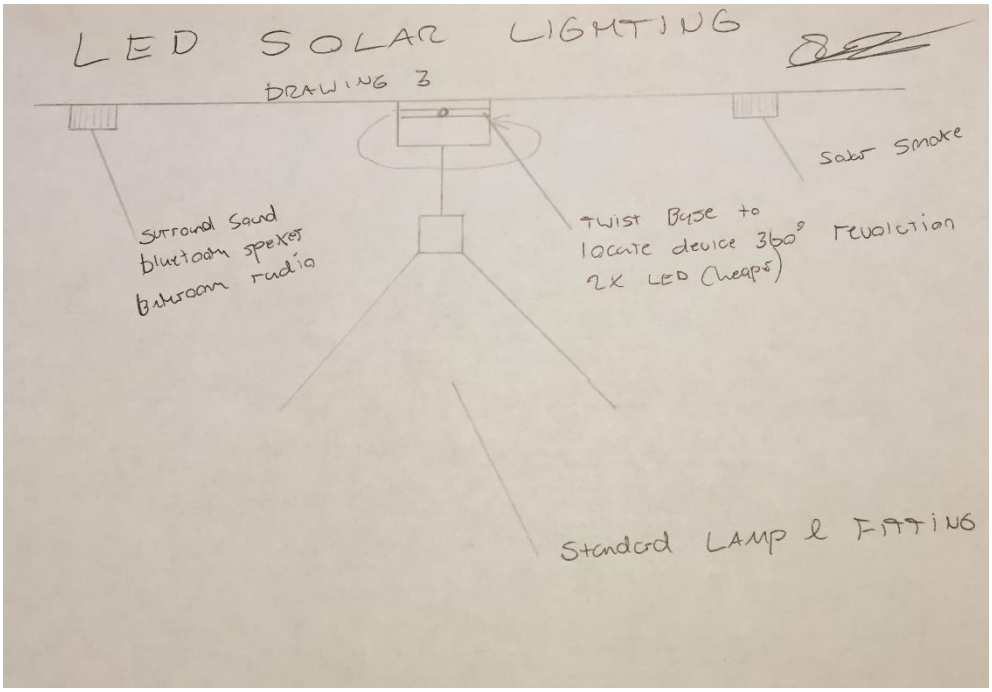


Figure 10 (Design Selection)

Ability

I put an answer to the internet for a quick conclusion as to not waste time,
The Question was simple.

Question

Can you charge solar panels with LED's.?

Answer

"An LED would be ideal because of its low power consumption. Solar cells use certain wavelengths of the light spectrum. An incandescent bulb produces all the wavelengths the sun does, but in different amounts. ... So, from a scientific standpoint, LEDs will probably produce the correct light to charge a solar cell." (panels?, 2017)

Ability to Carry Out

As an Electrician, and now with Mechanical knowledge, I can easily design a pendant. The hard decision is the choice of LED to power devices and then incorporate them into my design, to demonstrate choice selection, research and my own assumptions are used to determine the outcome of which LED to use.

About LED

Light Emitting Diode, is a semiconductor. They work by having two sides, positive and negative. Silicon is used as a base, by adding few atoms of the element Antimony, for extra electrons, Boron is used to decrease electrons that leave holes, we put the two materials together and the electrons move across and fill holes, leaving a boundary. Once a current is connected the electrons bounce back and forward thus creating light (Photon), known as forward bias.

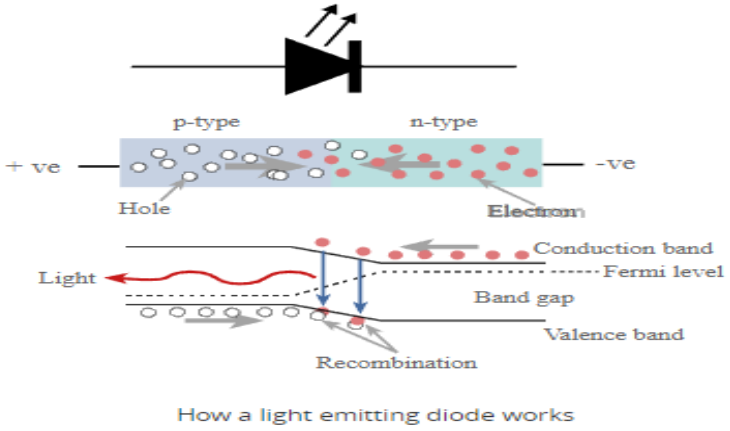


Figure 11 (How an LED Works)

(En.wikipedia.org, 2017)

LED Properties

Table 6 (LED Properties)

LED Colour	LED Material	Wavelength Range (Nm)	V_F @ 20MA
Ultra Violet	AlN, AlGaN, AlGaInN	<400	3.1 – 4.4
Violet	InGaN,	400 - 450	2.8 – 4.0
blue	InGaN, SiC	450 - 500	2.5 – 3.7
Green	GaP, AlGaInP, AlGaP	500 - 570	1.9 - 40
Yellow	GaAsP, AlGaInP, GaP	570 - 590	2.1 – 2.2
Orange	GaAsP, AlGaUInP, GaP	590 - 610	2.0 – 2.1
Red	AlGaAs, GaAsP, AlGaInP, GaP	610 - 760	1.6 – 2.0
Infrared	GaAs, AlGaAs	760>	< 1.9

(Newey.hk, 2017)

Table 7 (LED Wavelength Chart)

	Wavelength	Percentage of Sunlight
Ultraviolet	10 nm - 380 nm	46%
Violet	380 - 450 nm	7%
blue	450 - 495 nm	
green	495 - 570 nm	
yellow	570 - 590 nm	
orange	590 - 620 nm	
red	620 - 750 nm	
Infrared	750 - 1,000,000 nm	47%

(Solarpoweristhefuture.com, 2017)

Decision

Although Ultra Violet and Infrared are in abundance, solar cells do not react well with all types of light. Ultra Violet wavelengths hold too much energy and creates heat which reduces a solar cells efficiency, and the Infrared Light cannot produce enough energy to move the electrons in the first instance.

A combination from Violet to Red are used to mimic Daylight although this is not to be confused with Sun Light.

Choose Correct LED for Application

An LED that can supply enough light so that it can charge a device without any problems is required, so four types of LED Designs from the market will be chosen and compared against each other.

Decision Matrix

Table 8 (Decision Matrix, LED Type)

Competition	Competitor 1	Competitor 2	Competitor 3	Competitor 4
Lamp Type	Multi Small Chip	Multi Power Chip	High Power	Surface Mount
Drive Current	200 - 1000 Ma	200 - 700 Ma	50 - 400 Ma	5 - 20 Ma
Light Output	300 – 3000 lm	150 – 500 lm	50 – 400 lm	1 – 10 lm
Brand	Ostar	Xlamp MPL	Dragon	Top LED
Application	General	General	Portable	LCD Backing
Decision	yes	maybe	yes	no

(Slideshare.net, 2017)

Choice

Competitor 1, Multi small Chip LED

Decision

The application is general, we need at least 300 lumens, to obtain range for devices, 200 Ma is a small amount of energy required to run LED'S (0.2 watts). From looking at LED Small Multi Chips online, 300 lumen consumes 3-5 Watts of LED Lighting which is the equivalent of up to 50-watt incandescent lighting, watts used depends on the type of LED Colour for example, blue light gives more lumens than red, normally measured in Kelvin. Three watts of Blue can give the same amount of light as five watts Red.

1 Blue LED is equal to almost 2 Red LED, for the same output of light, the difference is the power consumed

Red (2200k),
Blue (4000k)

I am using a mix of colours from Violet to Red, a wavelength between 380 and 760nm. The Multi small Chip LED will have a combination 6 x of 50 lumen, LED'S (6 Band) taken from competitor 3, as size is a factor to consider. LED's, are to be connected in series with regards to the Small Multi Chip, this gives equal amounts of current at each LED and allows for the forward bias of LED's since components are connected end-to-end that form a single path for electrons to flow through the circuit.

Choose Spectrum of Light

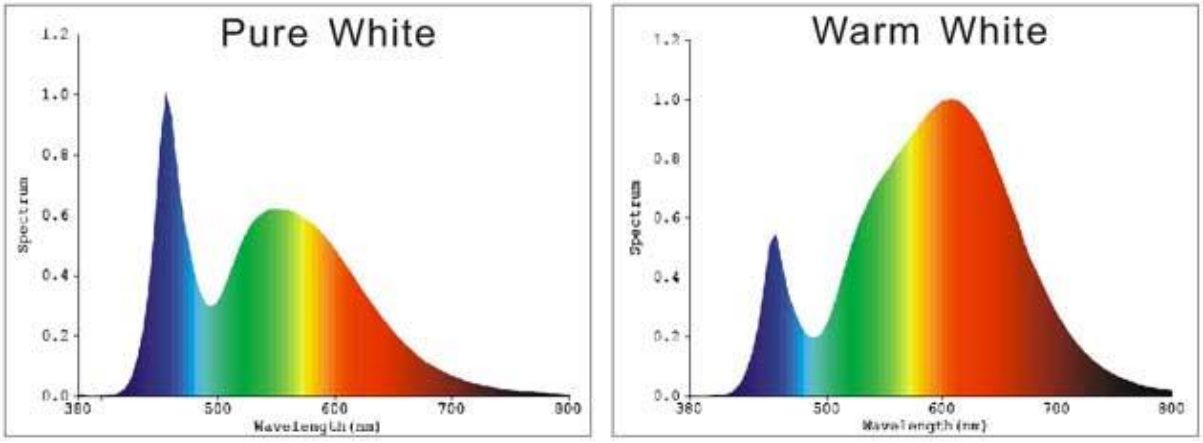


Figure 12 (Types of Light)

(Led-professional.com, 2017)

Pure White is daylight, Daylight Charges Solar the best, it has a high blue spectrum.

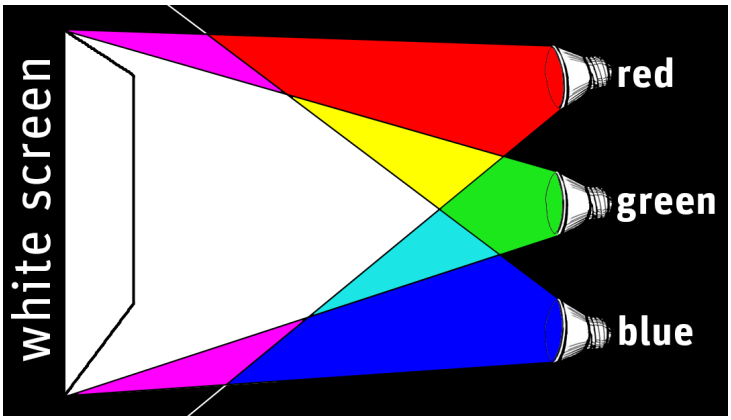


Figure 13 (Mixing of Light)

(Ladyada.net, 2017)

Choosing the type of light colour output dictates the type of LED's used

Primary	1 x Red	1 x Green	1 x Blue
Secondary	1 x Yellow	1 x Orange	1 x Red

The 6 colours when mixed give accurate daylight, which is best suited for Solar Panel Charging. This is also harmonised with standard lighting applications and could be considered as ambient lighting, thus the main lamp that is connected to the lamp holder for the room should require slightly less wattage, given an extra 2 x 300 lumen Daylight LED's are supplied.

Design type for Projection of the LED's

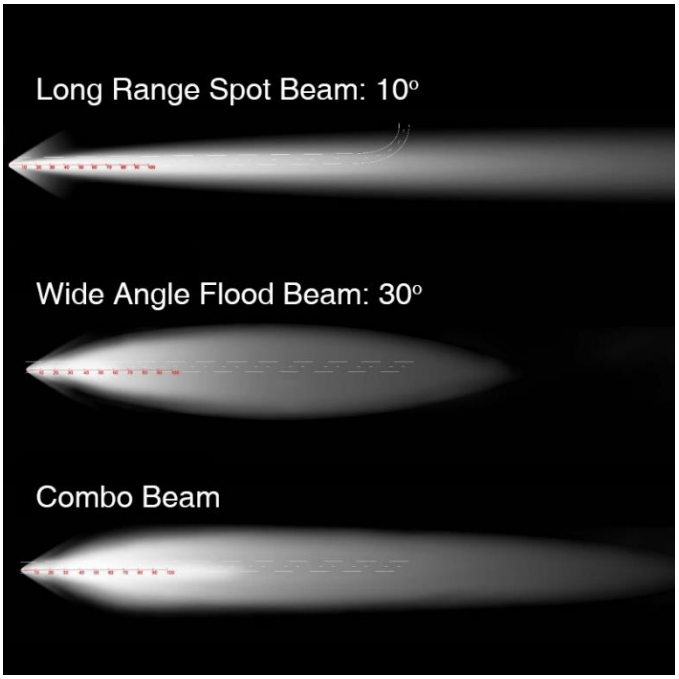


Figure 14 (Projection of Light)

(Universal, 2017)

Diffuser

Spot projects a more concentrated amount of light, and I am using 4-degree angle.

Complete

The correct LED and design is ready, and I must design my own LED housing to suit the small Multi Chip LED's and supply the LED Driver to suit the requirements of 10 Watt of power. I am not designing a Driver, I will purchase one that is readily available.

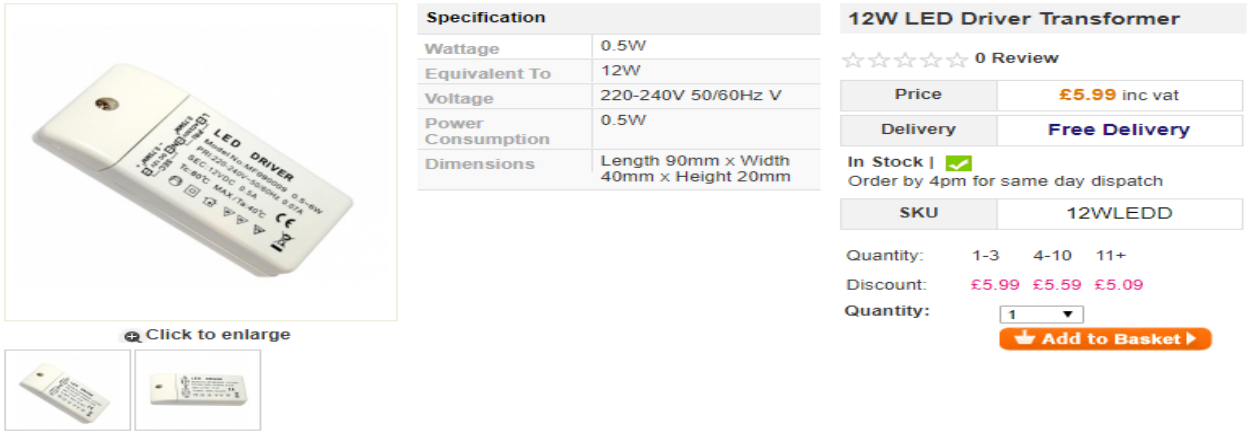


Figure 15 (Chosen LED Driver)

(Energylightbulbs.co.uk, 2017)

- Free delivery
- Cheaper than its competitors
- Power Input 0.5 W
- Power Output 12 W
- 30,000 hrs

200mA to run LED lights, but the LED Driver consumes 300mA, giving a total power consumption of 500mA (0.5 Watts).

Customer Requirements

As the design is unique, potential customers are unaware of the benefits of solar powered indoor capabilities. To help them understand, I will give potential clients a questionnaire based on my design, factors will include cost, practicality, efficiency and sustainability.

Questionnaire

Table 9 (questionnaire)

Question	Answer
Would you buy a light fitting that could wirelessly charge in-door solar powered smoke alarms and other small solar ceiling mounted devices using LED Projectors, if that meant over a period you saved money on Electricity?	Yes, sustainability and efficiency are key factors.
How much would you expect to pay for such a device?	£40-£70
would you like any other features?	No
What colour would you suggest?	White, chrome, silver and black
What small devices would you charge?	Smoke alarm, bathroom mirror,
Where would you put the light Pendant.	Bedroom, living room, bathroom, hallway
Where do you see this device being used?	Home, office, schools, businesses
Any further questions?	Would like to know about technology which allows for indoor solar devices to be charged directly from LED Projectors situated on the base of the light fitting.

Focus Meeting

As the idea is unique, a more in-depth analysis meeting with peers of the College to describe further in detail the aims and objectives of my Innovation, one being the cost of production, it should be no more than £600.

Conclusion of the Questionnaire and Focus Group

Staff are onboard with the idea, they accept it is a good idea that is effective, efficient and helps towards sustainability. Further, by ceiling mounted operation, there is eye protection as LED's are bright, the beam of light is spread horizontally across a ceiling, as opposed to vertical.

Functional Specification

Features	• Ceiling Rose Pattress with LED Projectors	• Powers Indoor Solar Devices	• Reduces Electricity and Battery usage	• Utilises Advances made in LED Technology	• Wireless charging

Product Specification

Materials used	Steel	Brass	Copper	Plastic	Silicon	Epoxy Resin

Component List	LED Driver	LED's	LED housing	300mm Flex Cable	150mm D Pattress	Connector Block	360 revolve base 150mm	Terminal Block (three connections) (5A)

Specification Pattress	5mm shell	D = 150mm H = 30mm	**L**ive, **N**eutral and **E**arth connections on LED Driver.	LED Driver	2 x 6mm slots for ceiling mount screws	Cable Clamp	20mm Knock out	High Density Plastic

Specification LED Plate	House's LED	D = 150mm H = 30mm	Allows for flex to pass through to Pattress	8mm Diameter central hole for flex outlet	High Density Plastic	360 Revolve for Position of Devices

LED Spot Specifications	30,000 hrs	6 band	D = 10mm W = 4 mm	2 x 5 watts	300 lumens	Material, silicon,

LED Driver Transformer Specifications	Input Wattage = 0.5	W = 40mm L = 90mm H = 20mm	Consumption 0.5 watt	**Input** 220–240 Volts	Output 12 Watts	Material, silicon,

Type of Light	LED (Multi Small Chip) Daylight
Operation	Self-Running
Maintenance	Clean lenses once a month
Mass properties	385g (Excludes flex, lamp holder, LED' Driver)

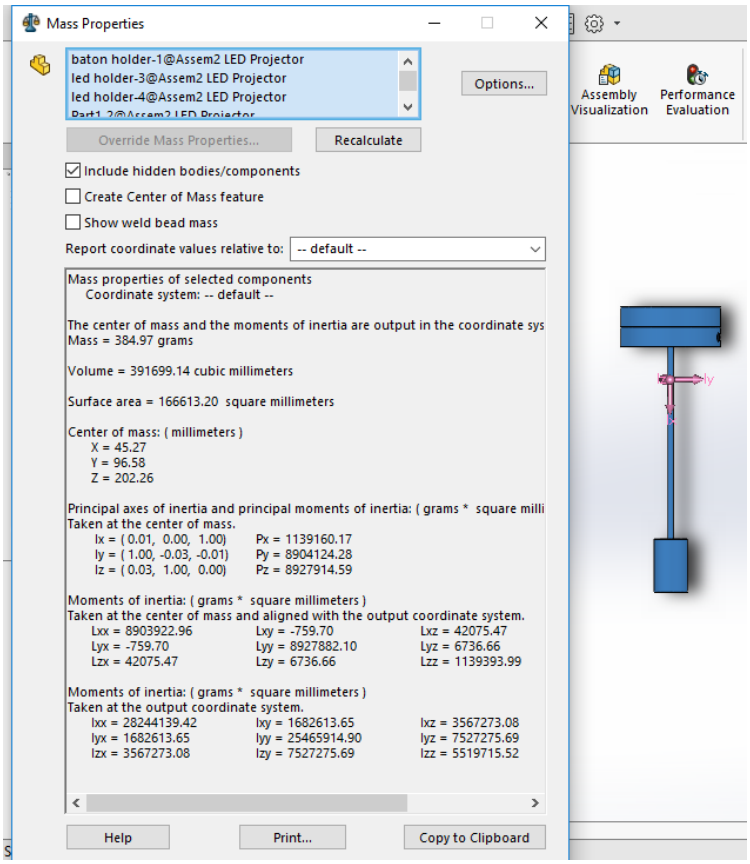


Figure 16 (Original Mass of Product)

SOLIDWORKS

Cost of Production for 20 units.

Table 10 (Production Cost)

Research and Development	£100
Raw Materials	£100
Machinery Rent	£200

Labour	£100
Marketing. Advertising	£100
	Total £600

Cost of Design

£600 (on budget)
£600/20 = £30 per unit to manufacture.

Selling Cost £60

Warranty

10 years (30,000 hrs)

Practicality

- Easy to install (Qualified Electrician)
- Easy to set up
- Suitable design for customers

Health and safety

RAMS, Risk Assessment and Method Statement proposed as an Ethics form.
Accepted by the Ethics committee (hypothetically).

Standards

ANSI/ESD S20.20:2014
BS EN 61340-5-1:2007 Electrostatic Control Standards

Review Design

Design is complete, but we need to review the design with further Customer Requirements.

Further Customer Requirements

Table 11 (Further Requirements)

Customer Requirements	Action
Reduce weight	Change material of Housing
Reduce Cost if optional	Will consider it.
Give it a name for marketing	ok

A further review is required that incorporates the above customer requirements- a Pugh and Matrix Chart will determine the outcome. The final design will incorporate all the before mentioned specifications and the new revised specifications.

Amendments to Specification

New Weight

380g

Material Change

Upon design I cannot make reductions other than material of the pattress and plate.

PE Low Density, Pattress and Plate material.

PE Low Density Properties Chart

Table 12 (Pattress Properties)

Property	Value	Units
Elastic Modulus	172	N/mm^2
Poisson's Ratio	0.439	N/A
Shear Modulus	59.4	N/mm^2
Mass Density	917	kg/m^3
Tensile Strength	13.27	N/mm^2
Compressive Strength		N/mm^2
Yield Strength		N/mm^2
Thermal Expansion Coefficient		/K
Thermal Conductivity	0.322	W/(m·K)
Specific Heat	1842	J/(kg·K)
Material Damping Ratio		N/A

(SolidWorks)

This method reduces weight and cost without consequences.

Cost of Production of 20 units

Table 13 (Revised Cost of Production)

Research and Development	£100
Raw Materials	£85
Machinery Rent	£200

Labour	£100
Marketing. Advertising	£100
	Total £585

Revised Cost of Design

£585 (£15 under budget)

Saving £15 over all on materials.

Name

Solar Charging Pendant (SCP)

Compare Designs

Pugh and Matrix

Table 14 (Compares Previous Design to the Latest Reviewed)

Criteria	Ideal	Design 3	Final Design
Reduce Weight	S	-	+
Reduce Cost	S	-	+
Give It a Name	S	-	+
Total +	0	0	3
Total -	0	3	0
Total Score	0	-3	3

Conclusion

The final design incorporates all aspects from engineers input to questionnaires and customer requirements.

Now we have all the data and design specification and will design in SolidWorks,

Final Design Using SolidWorks

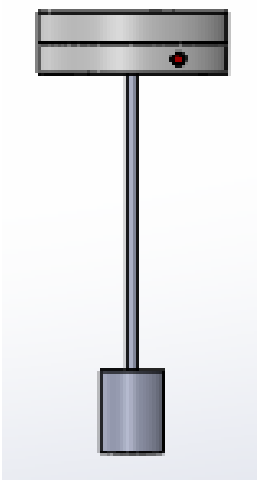


Figure 17 (Finished Product, Picture 1)

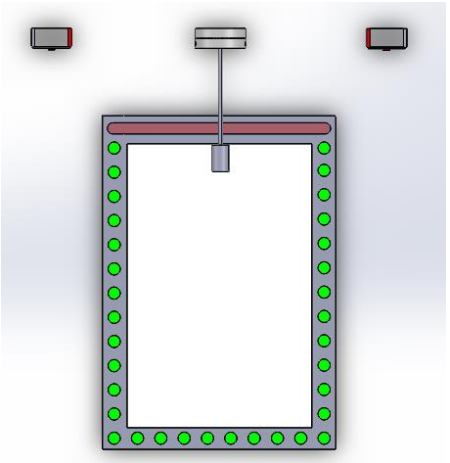


Figure 18 (Finished Product, Picture 2)

2D Drawings

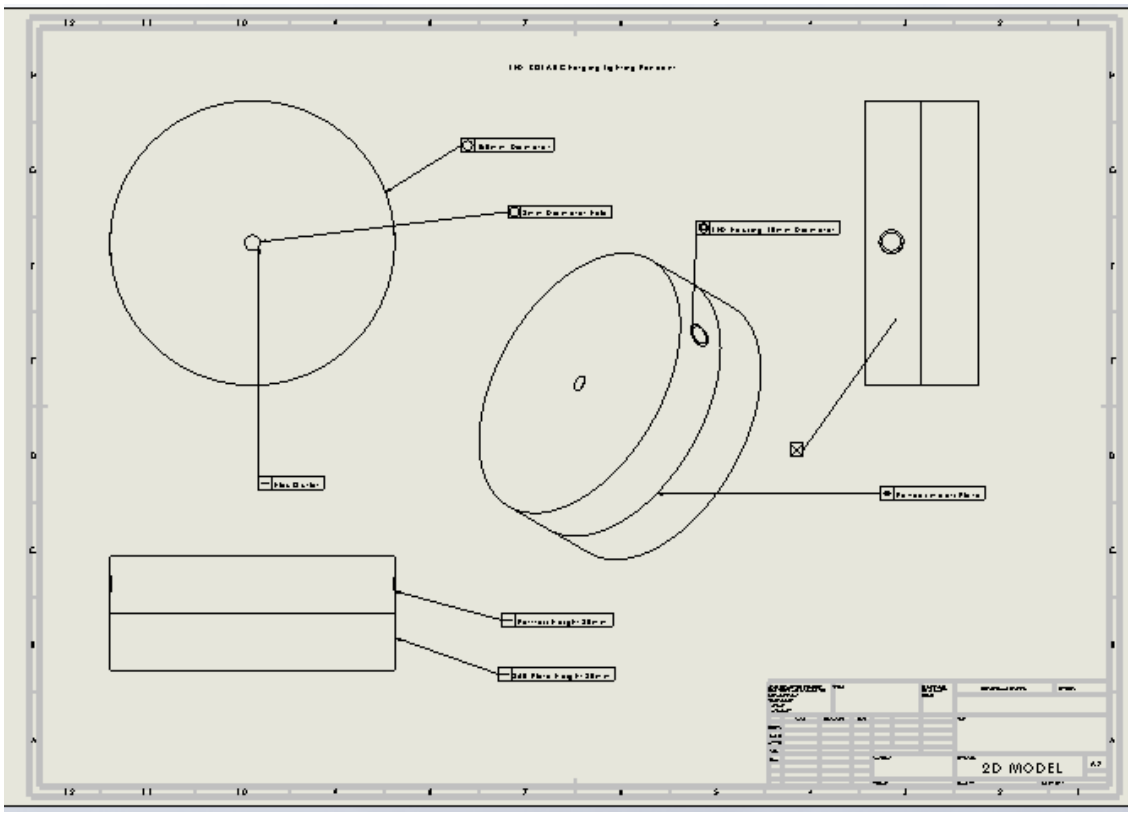


Figure 19 (2D, SolidWorks Design, Pattress Casing)

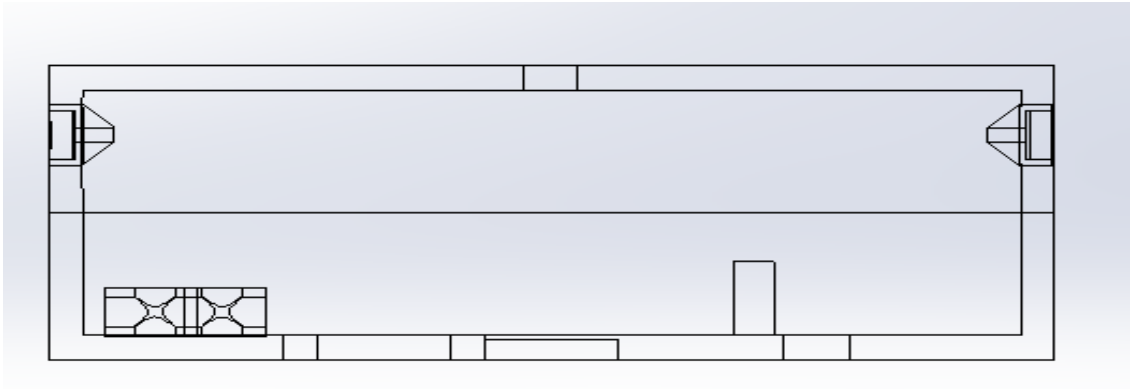


Figure 20 (Pattress Housing and Components)

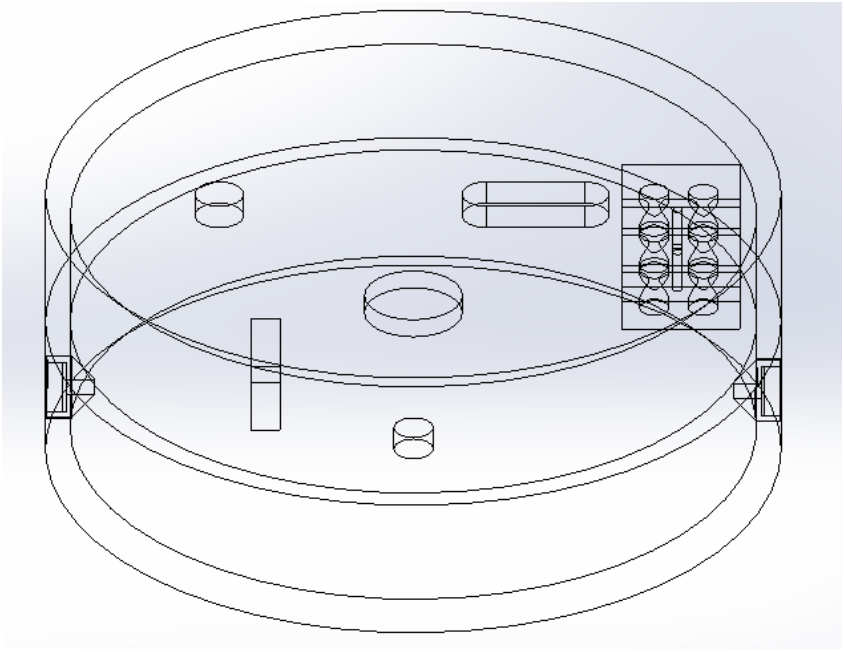


Figure 21 (Angled View of Design)

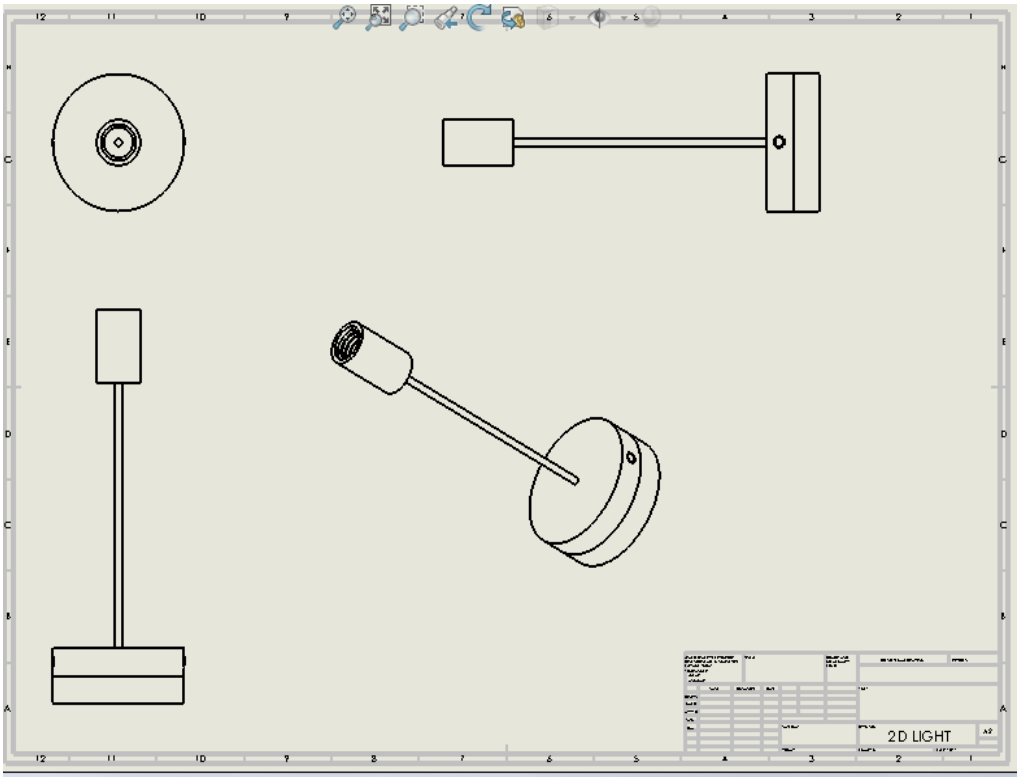


Figure 22 (2D Pendant and Lamp Holder)

Pictures

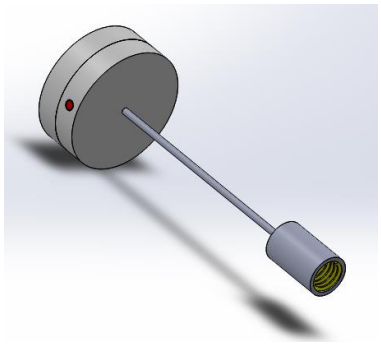


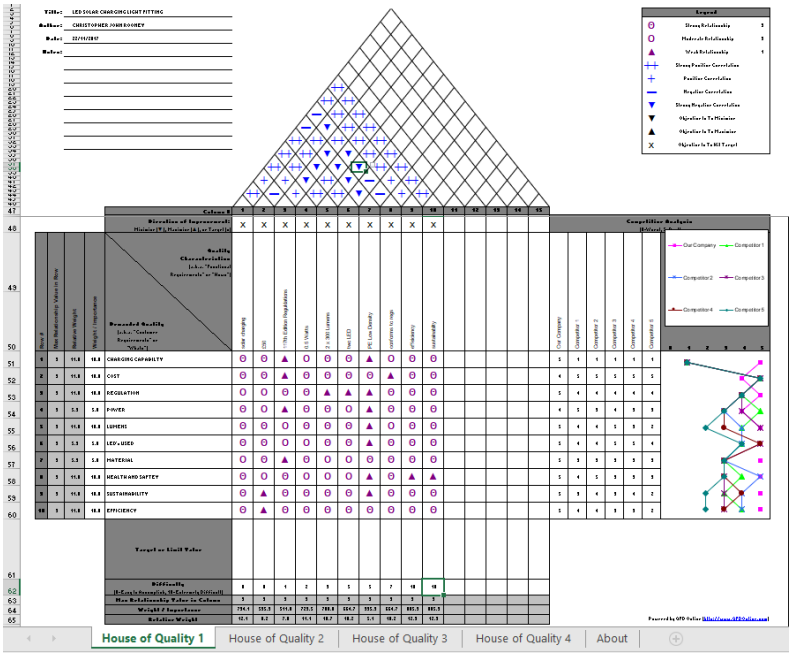
Figure 23 (Design Concept)

Figure 24 (LED Design)

Test Market

To compare to a hypothetical market, we use a House of Quality Chart. This will put my design against other competitors in the market.

Table 15 (House of Quality, Compares Against Competitors)



Conclusion

By using the House of Quality chart, my design meets all I set out to achieve. This chart compares against competition, and shows relationships between selected criteria. I can only compare the nearest to my design, given that my design is Innovating lighting solutions there is no similar comparison, and by adding the charging feature to the light fitting separates it from the rest completely.

Introduction

Introducing

LED Solar Charging Light Fitting

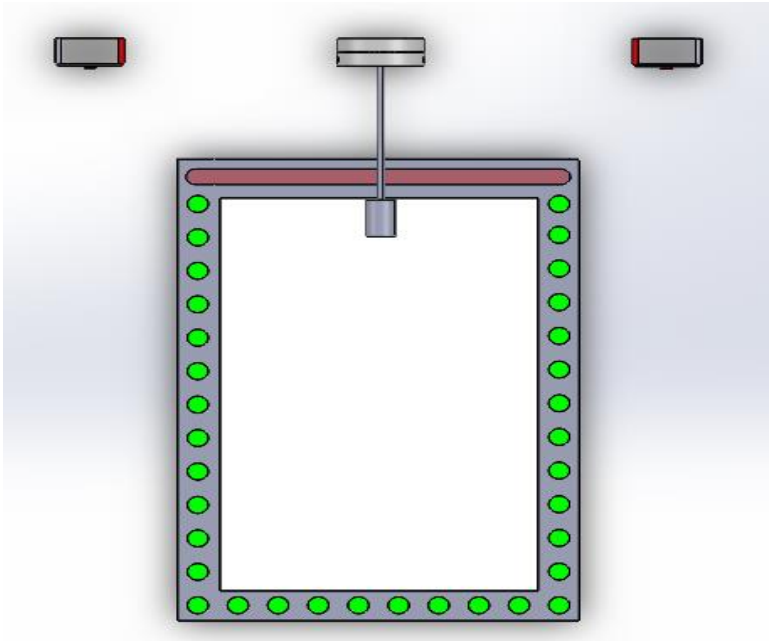


Figure 25 (Design Concept Picture)

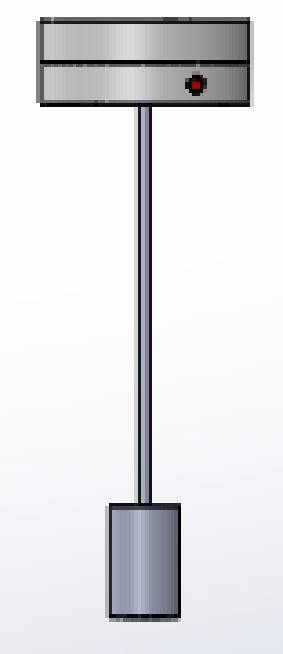


Figure 26 (Finished Design)

Functional Specification

Features

- Ceiling Rose Pattress with 2 x LED Projectors
- Powers Indoor Solar Devices
- Reduces electricity and battery usage and conversion of AC to DC.
- Utilises LED efficiency for a sustainable future.
- Wireless charging
- 10 Watt
- ANSI/ESD S20.20:2014 and BS EN 61340-5-1:2007 Electrostatic Control Standards.

Specification

Feature	Pattress mm	Plate mm	LED Driver	LED Small Multi chip Spot x 2
Height mm	30	30	20	
Width mm	150	150	15	4
Diameter mm	150	150		10
Input Power (Watts)			0.5 Watts	Watt

Output Power			12 Watts	
Lumens				300
Material	PE Low Density	PE Low Density	plastic	Plastic, poxy resin,
Weight (Grams)	150g	150g	70	15
Spectrum				6 Band
Standards	BS EN 61340-5-1:2007	BS EN 61340-5-1:2007	BS EN 61340-5-1:2007	BS EN 61340-5-1:2007
Cost	£150	£150	£200	£85

Figure 27 (Specification Chart)

Evaluation

Throughout this report critical evaluation has taken place. Therefore, this section should not be huge in terms of evaluations, more an overview with a review of tools and methods used.

We start out with the need for innovation, a plan and methodology highlighting issues and problems with efficiency and sustainability, the idea was to innovate a standard light fitting to incorporate LED Projectors.

First, I checked to see if there was any design like my idea on the market, used the market to further develop my ideas, taking pictures of LED Drivers and Lighting Pendants to avoid copy right, and to obtain data such as Regulations and BS standards.

To follow up the idea, four rough sketches were made, and a Pugh Matrix chart was used to weight the balance in terms of the best design, this concluded in a final draft (Drawing 3). To further the idea, it must able to become a product, this is where research and develop and testing for a real-life application needs to happen.

Utilising data, charts and conclusions. Adding my input into the design, alongside the customers' requirements, gives information for the Functional Specifications, and Product Specifications. At this point a further review is required to make sure everyone is happy, in this case further requirements are needed so a review and correction is made to the design, we can now design the product in SolidWorks for a more realistic analysis, however due to SolidWorks being a student edition, render of this Product has not been utilised.

A good idea has been put forward, but before we go further in terms of production we need to compare against any competitors using a House of Quality Chart, this compares all aspects of the design critically against itself, then against its competitors, it gives insight into the design by comparing all factors against each other, relevant or not.

Strength

A good way to reduce electricity, batteries, and some cases AC to DC converters and costly install factors. The Solar Charging Pendant is efficient compared to standard charging methods currently used, using a 0.5-Watt LED Driver, gives a 12-Watt output of LED Light, this is efficient, a standard mains operated smoke alarm uses 0.8 Watts of power, you probably have at least three of these devices at home, in every home, so energy savings on a big scale is huge, also this is just a concept, I have learnt the application of indoor solar charging could play a very important role in the future of efficiency and sustainability.

Weakness

Due to the early technology, I do worry the Spectrum of Light could be improved. I think cost may be a deterrent to some people. Also the fact that it is a two-part system means people will have to buy my devices, or my technology for their own devices, and maybe implementations in schools and industry is a bit out of reach, considering they have fully automated systems in place, without out real life application or expert advice it is hard to tell how it will do on the real market.

Tools Used Evaluation.

(Kepner Tregoe Matrix)

tools	**Application**	**Advantage**	**Disadvantage**	**Resolve If Necessary**
Gant Chart	Helps plan the production	Sets targets, and shows progress	It's a future plan, and may not be accurate.	To meet targets, review Gant Chart if necessary.
Pugh and Matrix	Selects components by comparing.	Easy to view chart.	Does not compare with competition, not as detailed.	No resolve.
House of Quality	Selects components and compares against competitors.	Compares all aspects of design in detail. And against competition.	Complex, small figure makes it difficult to see.	Zoom in on chart using Word or PDF.
Kepner Tregoe	Solutions to problems.	Highlights Potential issues.	Not enough detail.	No Resolve.
Questionnaire	Feedback from potential customers.	Helps to gain Design requirements	Not as accurate, as a focus group on technical aspects.	Add more detail, but public May not understand.
Focus Group	Detailed meeting regarding design and parameters	Specific details on technical aspects with an accredited team of Engineers.	Limited public access.	Invite public to meetings, help simplify and understand.
Customer Requirements	Input from the customer	Ultimately decides the design.	Sometimes unrealistic	Set Parameters in a clear easy

			proposals are put forward.	understanding way.

Figure 28 (Kepner Tregoe Chart, evaluating using Progressive Methods)

The tools utilised have helped me understand and further my knowledge in how to design and Evaluate an innovative product. Charts simplify everything, sometimes with so many factors it is hard to keep writing and remembering when a chart clearly highlights sections making them visible, also with the help of excel, House of Quality and Pugh and matrix charts are pre-configured, so it is easy to work with.

Intellectual Property

This innovation is hypothetical hence some features are missing; however, methodology leads me to this point where I have my design, and I know it has a good chance to be sold in the market.

It would be a good idea to safe guard the innovation, I have little understanding as to how to approach, so I have sent off for an information pack form a company called Innovate Product Design and they say, there are 4 main parts to a patent application.

- Abstract
- The claims
- Description
- Diagrams

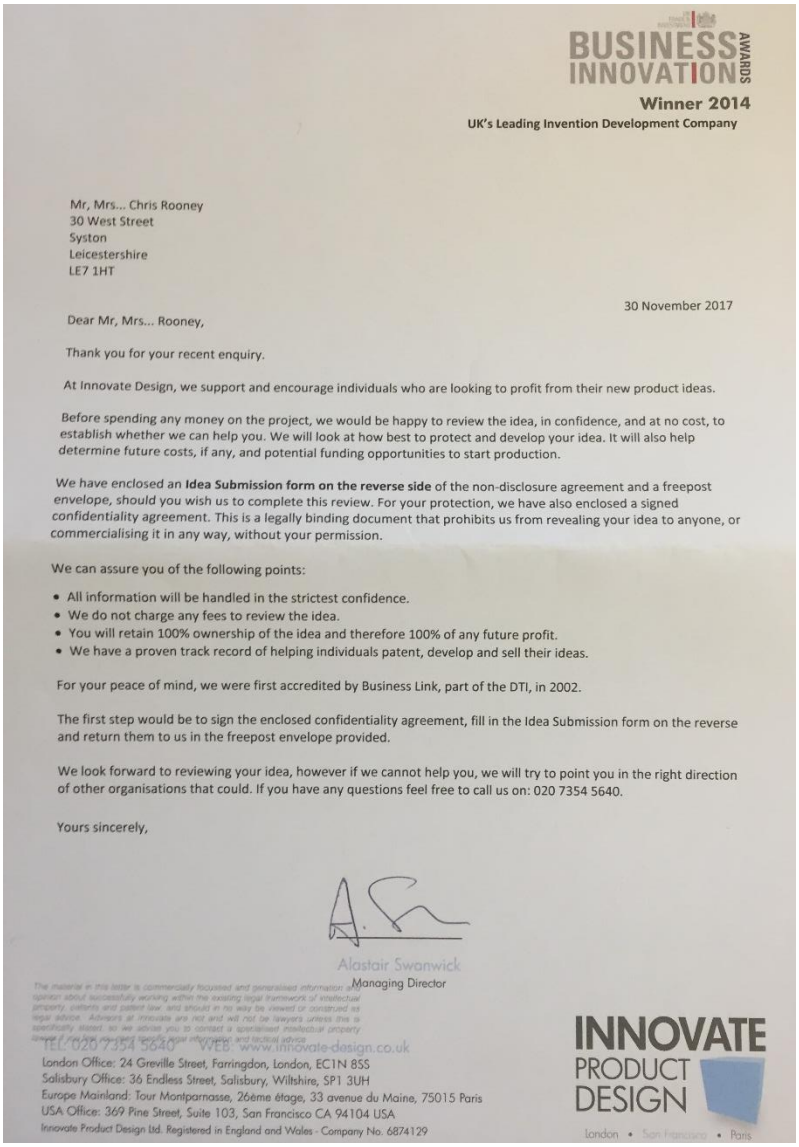
(Innovate Product Design, 2017)

this now conforms with BS 8538:2011

Which I have provided throughout the report, and sent off for my worked to be reviewed, there could be other ideas similar, that I am unaware of and they would be able to obtain information quicker as they have the right contacts.

If they come back and say chris we like the idea, as it is innovative and unique, could you send us more information?

I can send the PDS, and go from there, see confidentiality Agreement below.



BUSINESS INNOVATION AWARDS
Winner 2014
UK's Leading Invention Development Company

Mr, Mrs... Chris Rooney
30 West Street
Syston
Leicestershire
LE7 1HT

30 November 2017

Dear Mr, Mrs... Rooney,

Thank you for your recent enquiry.

At Innovate Design, we support and encourage individuals who are looking to profit from their new product ideas.

Before spending any money on the project, we would be happy to review the idea, in confidence, and at no cost, to establish whether we can help you. We will look at how best to protect and develop your idea. It will also help determine future costs, if any, and potential funding opportunities to start production.

We have enclosed an **Idea Submission form on the reverse side** of the non-disclosure agreement and a freepost envelope, should you wish us to complete this review. For your protection, we have also enclosed a signed confidentiality agreement. This is a legally binding document that prohibits us from revealing your idea to anyone, or commercialising it in any way, without your permission.

We can assure you of the following points:

- All information will be handled in the strictest confidence.
- We do not charge any fees to review the idea.
- You will retain 100% ownership of the idea and therefore 100% of any future profit.
- We have a proven track record of helping individuals patent, develop and sell their ideas.

For your peace of mind, we were first accredited by Business Link, part of the DTI, in 2002.

The first step would be to sign the enclosed confidentiality agreement, fill in the Idea Submission form on the reverse and return them to us in the freepost envelope provided.

We look forward to reviewing your idea, however if we cannot help you, we will try to point you in the right direction of other organisations that could. If you have any questions feel free to call us on: 020 7354 5640.

Yours sincerely,

Alastair Swanwick
Managing Director

The material in this letter is commercially focussed and generalised information and opinion about successfully working within the existing legal framework of intellectual property, patents and patent law, and should in no way be viewed or construed as legal advice. Advisors at Innovate are not and will not be lawyers unless this is specifically stated, so we advise you to contact a specialised intellectual property lawyer if you are requiring specific legal information and tactical advice.

TEL: 020 7354 5640 WEB: www.innovate-design.co.uk
London Office: 24 Greville Street, Farringdon, London, EC1N 8SS
Salisbury Office: 36 Endless Street, Salisbury, Wiltshire, SP1 3UH
Europe Mainland: Tour Montparnasse, 26ème étage, 33 avenue du Maine, 75015 Paris
USA Office: 369 Pine Street, Suite 103, San Francisco CA 94104 USA
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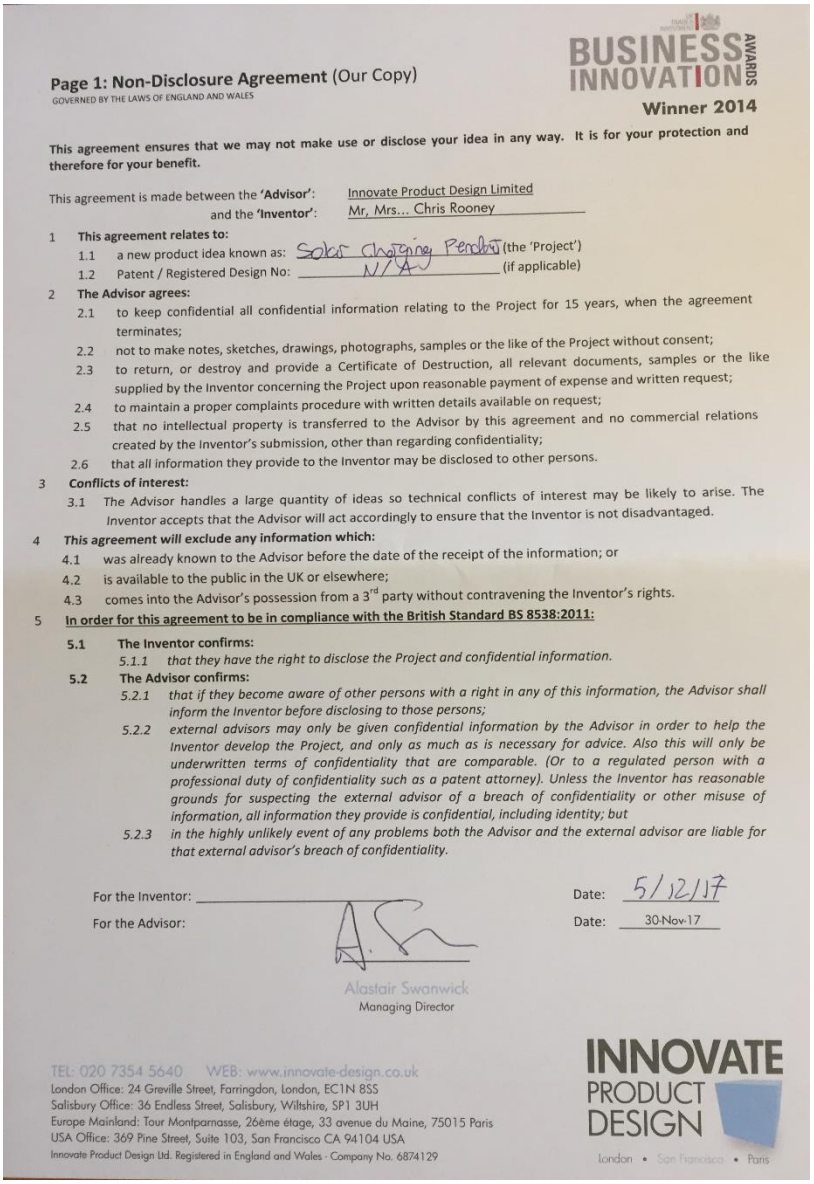
Figure 29 (Innovation Design Patent Form)

(Innovate Product Design, 2017)



Page 1: Non-Disclosure Agreement (Our Copy)

GOVERNED BY THE LAWS OF ENGLAND AND WALES

BUSINESS INNOVATION AWARDS
Winner 2014

This agreement ensures that we may not make use or disclose your idea in any way. It is for your protection and therefore for your benefit.

This agreement is made between the **'Advisor'**: Innovate Product Design Limited
and the **'Inventor'**: Mr, Mrs... Chris Rooney

1 **This agreement relates to:**
- 1.1 a new product idea known as: Solar Charging Pendant (the 'Project')
- 1.2 Patent / Registered Design No: N/A (if applicable)

2 **The Advisor agrees:**
- 2.1 to keep confidential all confidential information relating to the Project for 15 years, when the agreement terminates;
- 2.2 not to make notes, sketches, drawings, photographs, samples or the like of the Project without consent;
- 2.3 to return, or destroy and provide a Certificate of Destruction, all relevant documents, samples or the like supplied by the Inventor concerning the Project upon reasonable payment of expense and written request;
- 2.4 to maintain a proper complaints procedure with written details available on request;
- 2.5 that no intellectual property is transferred to the Advisor by this agreement and no commercial relations created by the Inventor's submission, other than regarding confidentiality;
- 2.6 that all information they provide to the Inventor may be disclosed to other persons.

3 **Conflicts of interest:**
- 3.1 The Advisor handles a large quantity of ideas so technical conflicts of interest may be likely to arise. The Inventor accepts that the Advisor will act accordingly to ensure that the Inventor is not disadvantaged.

4 ***This agreement will exclude any information which:***
- 4.1 was already known to the Advisor before the date of the receipt of the information; or
- 4.2 is available to the public in the UK or elsewhere;
- 4.3 comes into the Advisor's possession from a 3rd party without contravening the Inventor's rights.

5 **In order for this agreement to be in compliance with the British Standard BS 8538:2011:**

5.1 The Inventor confirms:
- *5.1.1 that they have the right to disclose the Project and confidential information.*

5.2 The Advisor confirms:
- *5.2.1 that if they become aware of other persons with a right in any of this information, the Advisor shall inform the Inventor before disclosing to those persons;*
- *5.2.2 external advisors may only be given confidential information by the Advisor in order to help the Inventor develop the Project, and only as much as is necessary for advice. Also this will only be underwritten terms of confidentiality that are comparable. (Or to a regulated person with a professional duty of confidentiality such as a patent attorney). Unless the Inventor has reasonable grounds for suspecting the external advisor of a breach of confidentiality or other misuse of information, all information they provide is confidential, including identity; but*
- *5.2.3 in the highly unlikely event of any problems both the Advisor and the external advisor are liable for that external advisor's breach of confidentiality.*

For the Inventor: _____ Date: 5/12/17

For the Advisor: Date: 30-Nov-17

Alastair Swanwick
Managing Director

TEL: 020 7354 5640 WEB: www.innovate-design.co.uk
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Salisbury Office: 36 Endless Street, Salisbury, Wiltshire, SP1 3UH
Europe Mainland: Tour Montparnasse, 26ème étage, 33 avenue du Maine, 75015 Paris
USA Office: 369 Pine Street, Suite 103, San Francisco CA 94104 USA
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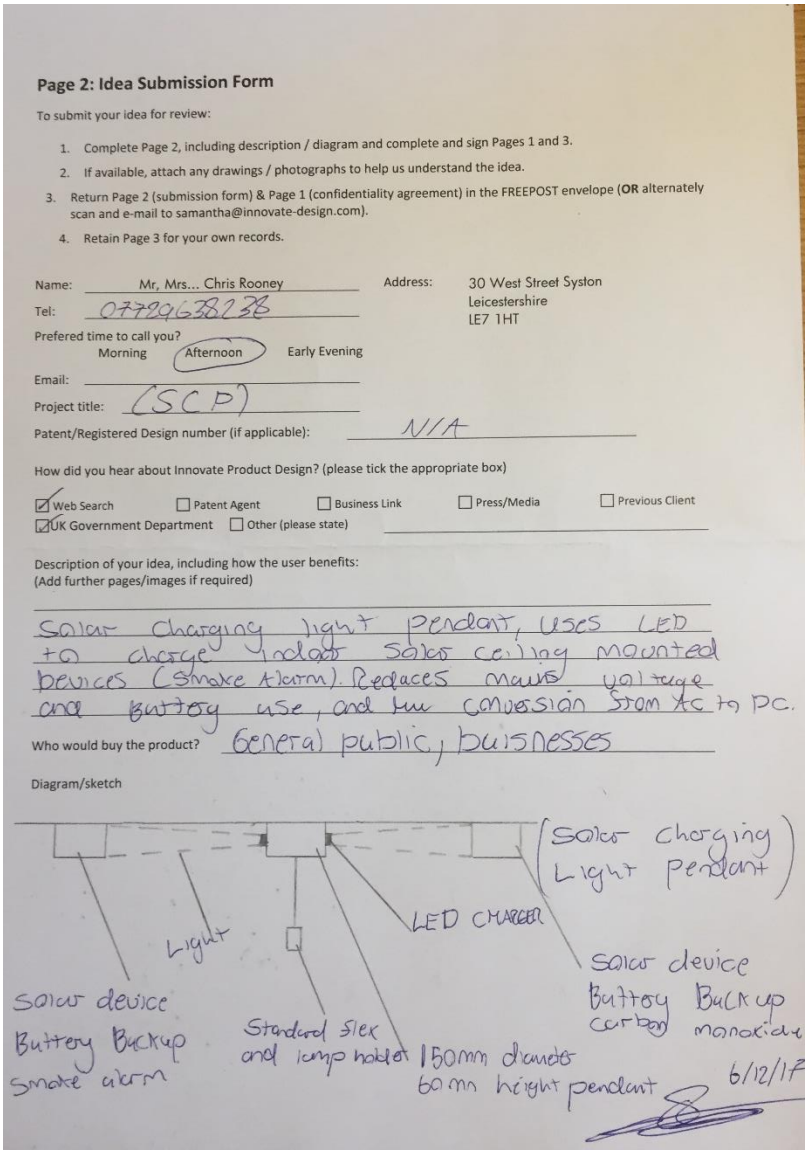
Figure 30 (Innovation Design Patent Form)

(Innovate Product Design, 2017)



Page 2: Idea Submission Form

To submit your idea for review:

1. Complete Page 2, including description / diagram and complete and sign Pages 1 and 3.
2. If available, attach any drawings / photographs to help us understand the idea.
3. Return Page 2 (submission form) & Page 1 (confidentiality agreement) in the FREEPOST envelope (**OR** alternately scan and e-mail to samantha@innovate-design.com).
4. Retain Page 3 for your own records.

Name: Mr, Mrs... Chris Rooney
Address: 30 West Street Syston, Leicestershire, LE7 1HT
Tel: 07790638238
Prefered time to call you? Morning (Afternoon) Early Evening
Email:
Project title: (SCD)
Patent/Registered Design number (if applicable): N/A

How did you hear about Innovate Product Design? (please tick the appropriate box)

☑ Web Search ☐ Patent Agent ☐ Business Link ☐ Press/Media ☐ Previous Client
☑ UK Government Department ☐ Other (please state)

Description of your idea, including how the user benefits:
(Add further pages/images if required)

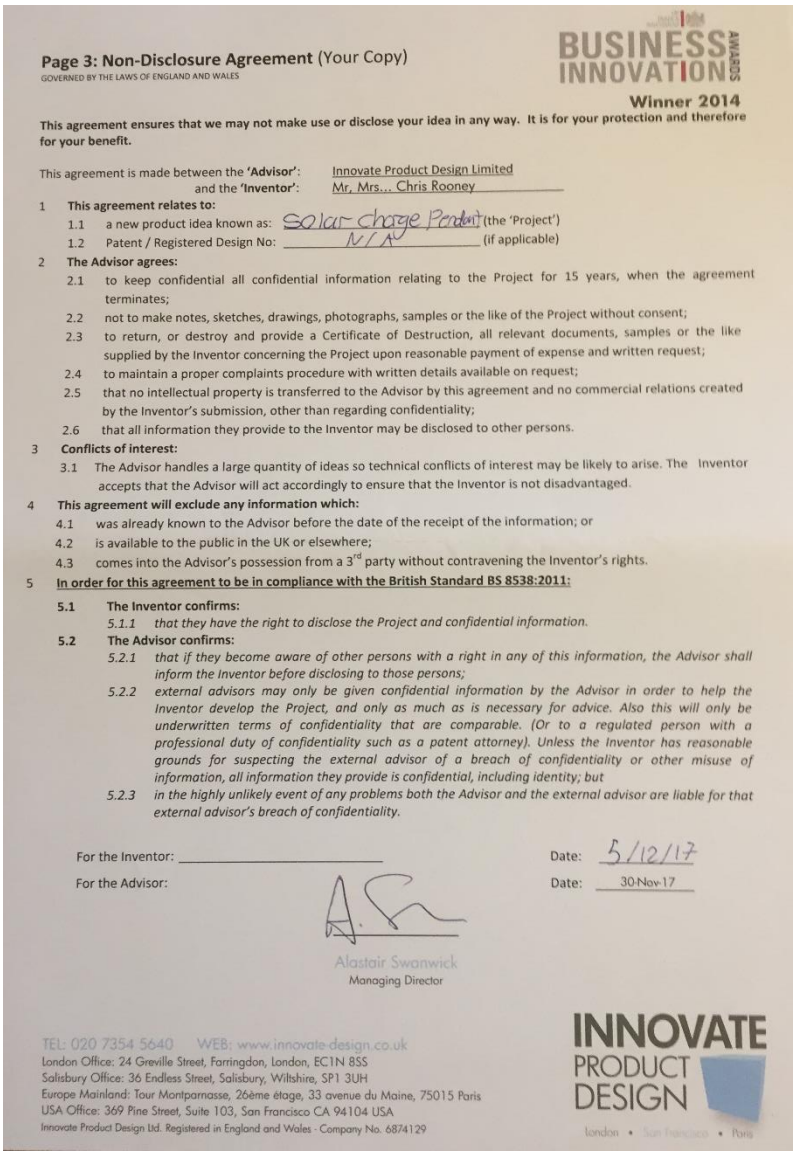
Solar charging light pendant, uses LED to charge indoor solar ceiling mounted devices (Smoke Alarm). Reduces mains voltage and battery use, and low conversion from Ac to DC.

Who would buy the product? General public, buisnesses

Diagram/sketch

Figure 31 (Innovation Design Patent Form)

(Innovate Product Design, 2017)



Page 3: Non-Disclosure Agreement (Your Copy)
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Winner 2014

This agreement ensures that we may not make use or disclose your idea in any way. It is for your protection and therefore for your benefit.

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Figure 32 (Innovation Design Patent Form)

(Innovate Product Design, 2017)

The End

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Appendix

WAVELENGTH RANGE (NM)	COLOUR	V_F @ 20MA	MATERIAL
< 400	Ultraviolet	3.1 - 4.4	Aluminium nitride (AlN) Aluminium gallium nitride (AlGaN) Aluminium gallium indium nitride (AlGaInN)
400 - 450	Violet	2.8 - 4.0	Indium gallium nitride (InGaN)
450 - 500	Blue	2.5 - 3.7	Indium gallium nitride (InGaN) Silicon carbide (SiC)
500 - 570	Green	1.9 - 4.0	Gallium phosphide (GaP) Aluminium gallium indium phosphide (AlGaInP) Aluminium gallium phosphide (AlGaP)
570 - 590	Yellow	2.1 - 2.2	Gallium arsenide phosphide (GaAsP) Aluminium gallium indium phosphide (AlGaInP) Gallium phosphide (GaP)
590 - 610	Orange / amber	2.0 - 2.1	Gallium arsenide phosphide (GaAsP) Aluminium gallium indium phosphide (AlGaUInP) Gallium phosphide (GaP)
610 - 760	Red	1.6 - 2.0	Aluminium gallium arsenide (AlGaAs) Gallium arsenide phosphide (GaAsP) Aluminium gallium indium phosphide (AlGaInP) Gallium phosphide (GaP)
> 760	Infrared	< 1.9	Gallium arsenide (GaAs) Aluminium gallium arsenide (AlGaAs)

(Newey.hk, 2017)

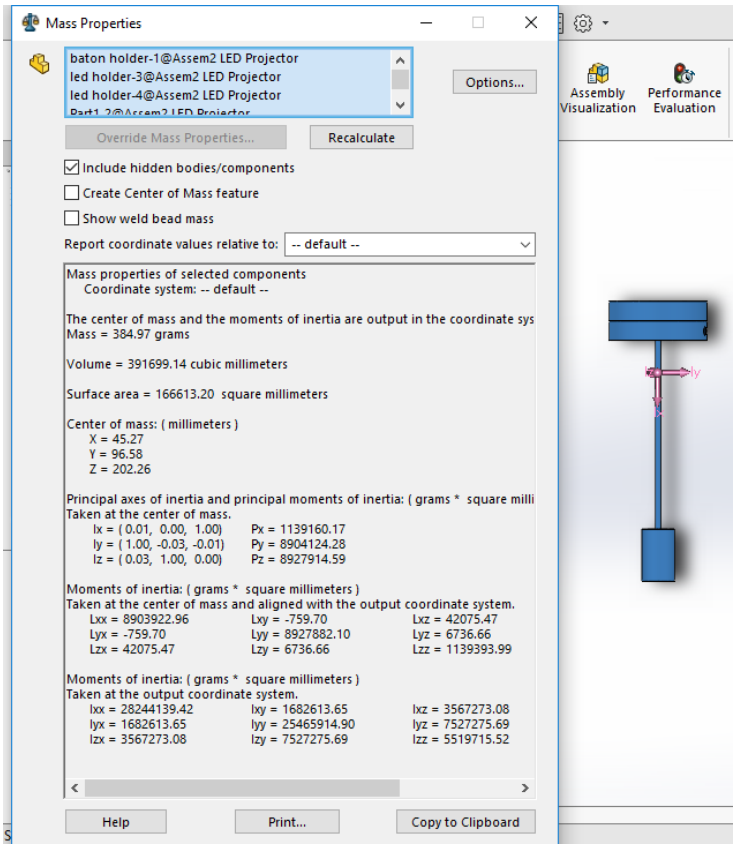
PE High Density Properties Chart (SolidWorks)

Property	Value	Units
Elastic Modulus	1070	N/mm^2
Poisson's Ratio	0.4101	N/A
Shear Modulus	377.2	N/mm^2
Mass Density	952	kg/m^3
Tensile Strength	22.1	N/mm^2
Compressive Strength		N/mm^2
Yield Strength		N/mm^2
Thermal Expansion Coefficient		/K
Thermal Conductivity	0.461	W/(m·K)
Specific Heat	1796	J/(kg·K)
Material Damping Ratio		N/A

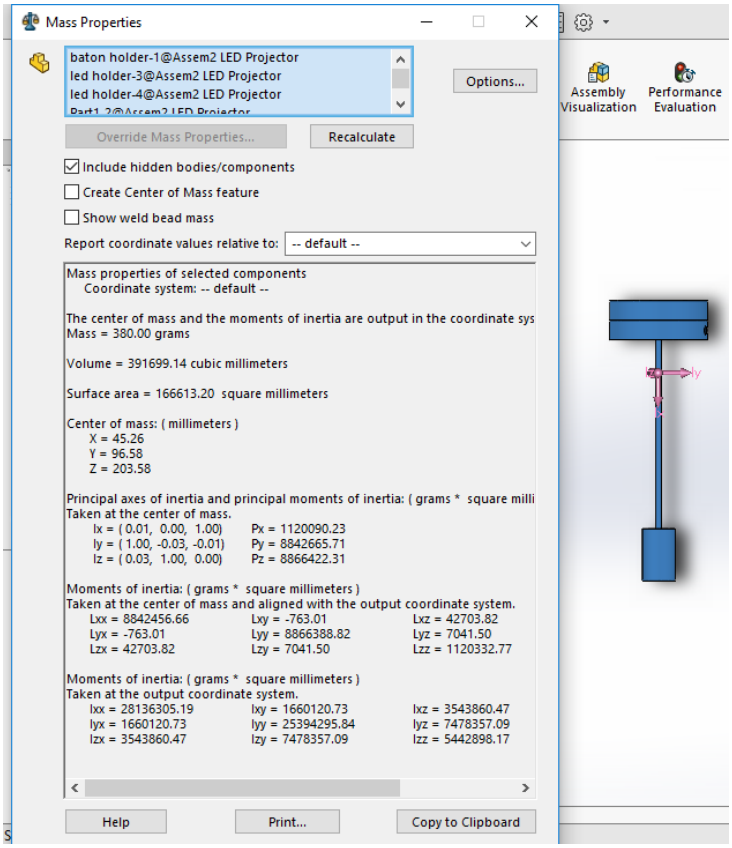
PE Low Density Properties Chart (SolidWorks)

Property	Value	Units
Elastic Modulus	172	N/mm^2
Poisson's Ratio	0.439	N/A
Shear Modulus	59.4	N/mm^2
Mass Density	917	kg/m^3
Tensile Strength	13.27	N/mm^2
Compressive Strength		N/mm^2
Yield Strength		N/mm^2
Thermal Expansion Coefficient		/K
Thermal Conductivity	0.322	W/(m·K)
Specific Heat	1842	J/(kg·K)
Material Damping Ratio		N/A

SolidWorks Mass Measure Data



Revised SolidWorks Mass Measure Data



The end.